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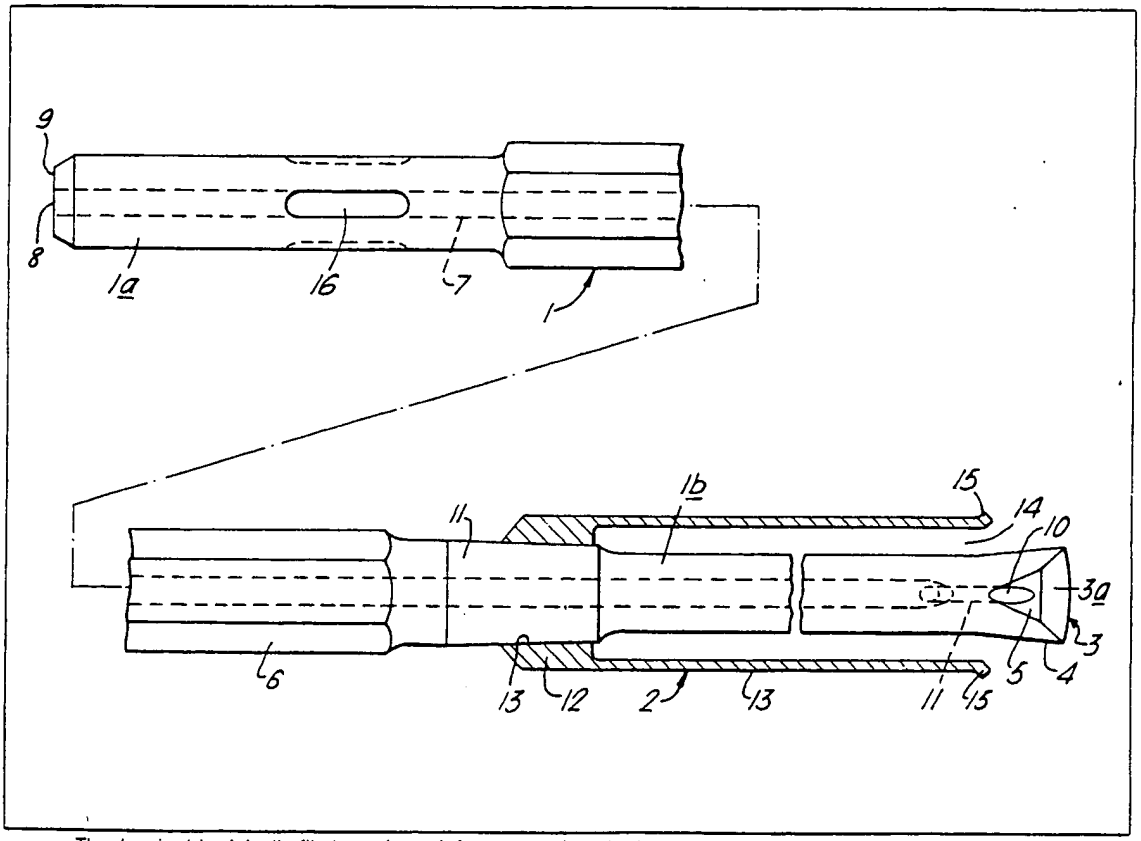
(54) Rotary-percussive drill assembly

(57) A rotary/percussive drill assembly consists of a drill rod 1 and a hollow core drill body 2. The rod 1 has a frusto conical taper 11 on which is frictionally engaged a complementary tapered aperture 13 of the drill body 2 so that a skirt 13 of the drill body extends towards a chisel-bit end cutting part 3 of the drill rod. The end of the skirt 13 adjacent the chisel bit 3 has an array of cutting parts 15.

Extending longitudinally through the drill rod is a passage 7 having an inlet port 8 and an outlet port 10 by which flushing fluid such as air under pressure is directed into the region of cutting to facilitate the removal of detritus and permit relatively high drilling rates with increased life for the cutting parts.



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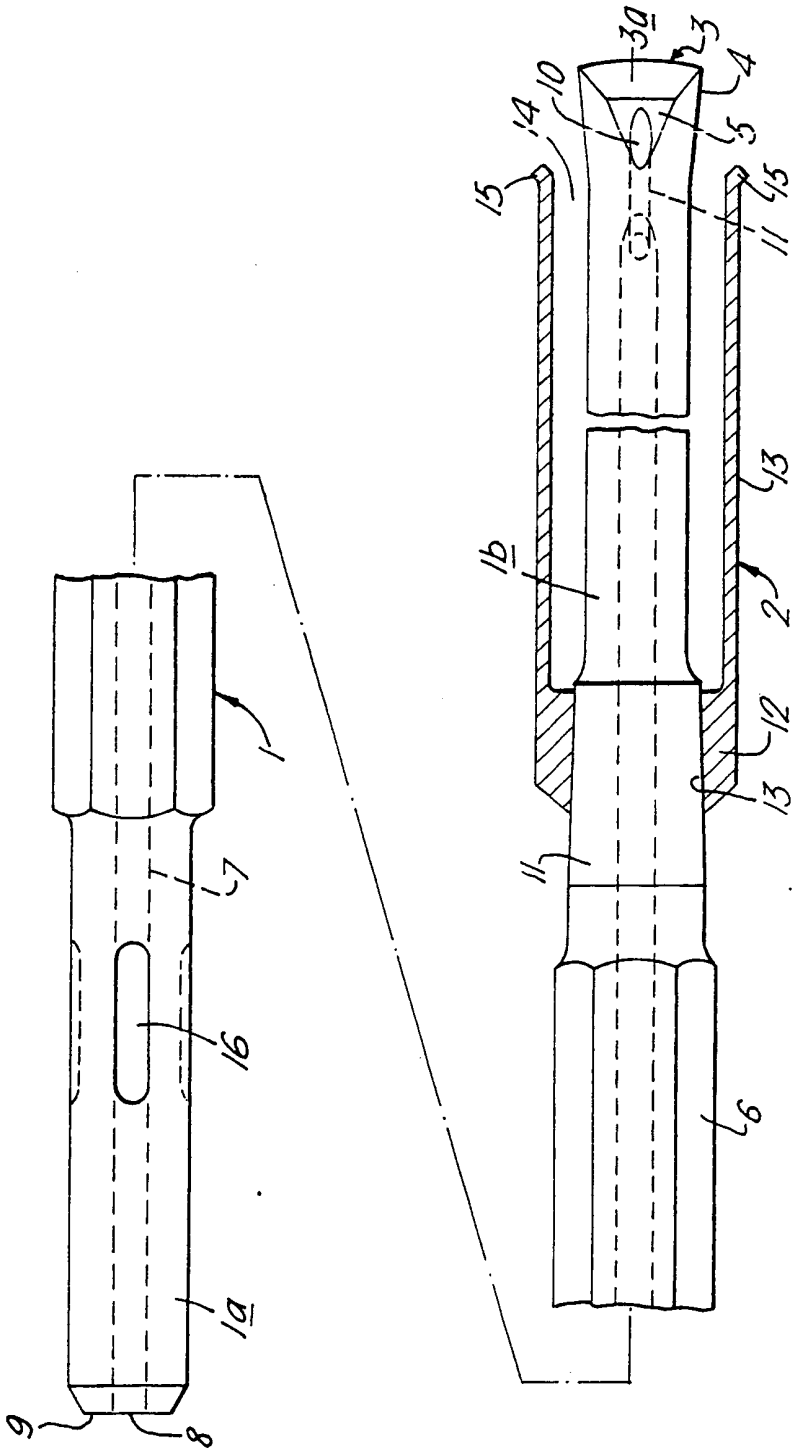

SPECIFICATION

A rotary/percussive drill assembly

TECHNICAL FIELD AND BACKGROUND ART

This invention relates to a rotary/percussive drill assembly and is particularly concerned with such an assembly which incorporates a hollow core drill for heavy duty use.

Hollow core drill assemblies are well known, primarily for use with hand held rotary/ hammer type drilling machines where they are frequently employed, for example, for drilling masonry. Conventionally hollow core drills are formed as an assembly of at least three and usually four omponents; a taper adaptor, a cup-shaped hollow core drill body frictionally secured by complementary engaging tapered surfaces to the adaptor, and a helically fluted twist or pilot drill mounted in the adaptor to extend concentrically through the hollow core drill body to provide a centering or leading cut for a larger diameter cutting region which is to be effected by cutting parts carried around the mouth of the drill body. The fourth component which is conventionally recognised as a practical necessity is a shank adaptor which is fitted to the taper adaptor and which provides the assembly with a shank suitable to be accepted by the drilling machine. Hollow core drills of this type are advantageous in that they can be employed to drill different diameter holes merely by replacing one hollow core drill body for another of appropriate diameter. However the hitherto proposed components from which they are assembled and the nature of their assembly have proved unattractive for practical purposes where not only is it necessary for different sized core drill bodies to be provided but also different sized pilot drills and adaptors which are necessary to select and assemble together to provide the required structure. Furthermore, the rate of drilling which can be achieved in practice with the prior proposed core drill assemblies and the relatively short working life of the pilot drill and cutting parts of the core drill body leave much to be desired. It is believed therefore that there is a need for a heavy duty hollow core drill assembly which lends itself to ease of manufacture and assembly, permits a relatively high drilling rate and provides an improvement in the life expectancy of its cutting parts; it is an object of the present invention to provide a rotary/percussive drill assembly which is capable of satisfying the aforementioned need.

STATEMENT OF INVENTION AND ADVANTAGES

According to the present invention there is provided a rotary/percussive drill assembly which consists of a longitudinally extending drill rod and a hollow core drill body carried by said drill rod with the rod extending longitudinally through the drill body; said drill rod comprising a cutting part at one end, at its other end a shank part by which the assembly is to be engaged with a rotary/percussive drilling machine, and a longitudinally extending externally tapered portion which converges towards its cutting part; said hollow core drill body comprising a base having an internally tapered aperture within which said externally tapered portion is received in complementary manner to provide frictional driving engagement between the drill rod and the drill body, a skirt extending longitudinally from said base in the direction of the drill rod cutting part to provide a mouth through which the drill rod extends, and an array of cutting parts on the drill body peripherally disposed about the mouth, and wherein the drill rod is provided with an internal conduit which communicates between an inlet port in the shank part and an outlet port disposed longitudinally between the cutting part of the drill rod and the region of engagement between the internal and external tapers and through which flushing fluid is to be passed into the region of cutting for the assembly.

Further according to the present invention there is provided the combination of a drill assembly as specified in the immediately preceding paragraph and a rotary/percussive drilling machine comprising a socket within which the shank part is received and wherein the inlet port communicates with a fluid line in the machine through which fluid under pressure is supplied for flushing.

By the present invention the drill assembly consists of two components, the drill rod and the hollow core drill body which is removably mounted on the rod by the frictional or wedge engagement between the complementary internal and external tapers provided on the two components (so permitting one drill body to be changed for another to provide different diameter bores in the conventionally accepted manner). Each of the two necessary components may readily be manufactured by conventional techniques. Possibly of more importance from the practical and commercial aspect however is the provision of the internal passage in the drill rod which permits flushing fluid (which will usually be air under pressure) to be directed into the cutting region to assist in the removal of detritus from that region; by this technique not only has it been found that there is a considerable improvement in the rate of drilling but also the life expectancy of the cutting parts have shown a substantial improvement. Generally rotary/percussive drilling machines are pneumatically operated and conveniently the flushing fluid is derived from an air pressure source within the machine. For this latter purpose the inlet port is preferably located in an end face of the drill rod (on the shank part) so that that port will

communicate directly with an air pressure line in the drilling machine when the shank part is received within the retaining socket of that machine.

If required two or more outlet ports can be provided for the internal conduit. Preferably the or an outlet port is positioned at or adjacent to the cutting part of the drill rod to direct flushing fluid primarily into the cutting region of that part. Bearing in mind that the cutting part of the drill rod may often lead the cutting parts of the hollow core drill body to a considerable extent longitudinally, the backward flow of flushing fluid from an outlet port adjacent to the cutting part on the drill rod will usually serve to provide sufficient flushing characteristics to maintain the effectiveness of the cutting parts on the drill body; if required however an outlet port can be provided specifically to promote flushing of detritus from the cutting parts on the drill body.

The internal and external tapers of the drill body and drill rod respectively will usually be frusto conical. The longitudinal extent of the external taper is preferably greater than that of the internal taper so that wear between the opposing surfaces can be accommodated by the internal taper moving longitudinally over the external taper. The drill rod will usually include provision in the region of its external taper by which an appropriate extractor can be fitted to knock-off the drill body.

The cutting parts for thedrill rod and drill body are preferably provided by inserts of hard material such as tungsten carbide appropriately secured within their respective components to provide rotary/percussive drilling in conventional manner.

Preferably a hard material insert provides the drill rod with a chisel-bit type cutting part. However it will be appreciated that other forms of cutting part may be employed (such as a cross-bit type) each of which can be used independently of the hollow core drill body (that is without the drill body being fitted to form the assembly) to form a pilot bore hole in masonry and which, with the drill body attached, can provide relatively small chippings of rock or brick within the diameter of the bore defined by the cutting parts of the drill body which chippings are rapidly cleared by the flushing fluid.

If required the hollow core drill body can be provided with flushing outlets such as apertures or slots in its base or skirt through which detritus may be removed from the cutting region and from the enclosure of the skirt by the flushing action of the pressurised fluid.

The shank part of the drill rod will be of an appropriate shape and size to be received in conventional manner within the sockets of drilling machines whereby the drill assembly will be capable of restricted longitudinal displacement relative to the socket to provide the required percussive drilling effect whilst undergoing continuous or intermittent rotation.

DRAWING

One embodiment of a drill assembly constructed in accordance with the present invention will now be described, by way of example only, with reference to the accompanying illustrative drawing which is a side elevation of the assembly with the hollow core drill body being shown in longitudinal section.

DETAILED DESCRIPTION OF DRAWING

The rotary/percussive drill assembly consists of a longitudinally extending drill rod 1 and a hollow core drill body 2. One end part length of the drill rod provides a cylindrical shank 1*a* while its opposite end part length 1*b* is provided with a chisel-bit type cutting part 3. For this bit end a tungsten carbide chisel insert 4 is secured by brazing in a complementary slot in an end face 3*a* of the drill rod. Part length 1*b* of the drill rod adjacent to the chisel bit 3 is cylindrical and diametrically opposed chamfers 5 provide transition regions between the cylindrical part and the end face 3*a*. A mid-section 6 of the drill rod disposed between the shank 1*a* and cylindrical part length 1*b* adjacent to the chisel-bit will likely be the longest part of the drill rod and is shown of hexagonal section (although other sections may be employed as convenient).

Extending longitudinally through the drill rod and generally concentric therewith is a flushing pasage 7 which communicates between an inlet pot 8 in the end face 9 at the shank end of the rod and an outlet port 10 disposed in a chamfered surface 5 adjacent to the cutting insert 3. For convenience of manufacture and also to direct flushing fluid forwardly in the direction of drilling the internal passage includes an angled branch passage 11 through which the outlet port 10 communicates with a concentric bore which forms the major part of the internal passage.

Disposed on the drill rod 1 at a position longitudinally between the mid-section 6 and the cylindrical part length 1*b* adjacent to the chisel-bit end is an external frusto conical surface 11 the taper of which convergess towards the chisel insert 3.

The drill body 2 has a base 12 extending from which is a generally cylindrical skirt 13. Provided in the base 12 is an aperture 13 having an internal frusto conical taper which is complementary to the taper 11 and concentric with the skirt 13. The drill body 2 is received on the drill rod 1 with the tapers 11 and 13 in mating relationship so that the two components are frictionally retained in engagement with the skirt 13 being directed longitudinally towards the chisel-bit end of the drill rod. The drill rod extends longitudinally and concentrically through the mouth 14 of

the skirt with a clearance being provided between the drill rod and the skirt. Carried in the free end of the skirt which forms a lip to the mouth 14 is a circumferentially spaced array of tungsten carbide inserts 15 which provide cutting parts for the drill body 2. The inserts 15 are conveniently secured by brazing in slots in the skirt 13 and are offset to provide clearance cutting for the external diameter of the skirt 13 (and also for the largest lateral dimension of the drill rod over the length thereof between the skirt 13 and the end face 9).

In use the drill assembly is mounted in a rotary/percussive drilling machine which may be of the pneumatically operated hammer type. For this purpose the shank 1*a* is provided with a circumferentially spaced array of longitudinally extending recesses 16 forming slideways by which the drill rod is coupled to the retaining socket of the machine within which the shank is received and so that the inlet port 8 communicates with a high pressure air line from the machine. The end face 9 is repeatedly impacted by a reciprocating hammer of the machine while the coupling to the slideways 16 permits restricted longitudinal displacement of the assembly and continuous or intermittent rotation of the assembly. With the assembly so mounted the chisel-bit end 3 will exhibit rotary/percussive drilling in a manner conventional for rotary/percussive chisel bits and provide a pilot bore hole in masonry for the following rotary/percussive drilling exhibited by the inserts 15 on the drill body 2. Removal of detritus formed during such drilling is facilitated by the flushing effect of the high pressure air emanating through the outlet port 10. The detritus is carried by the air stream around the outside of the skirt 13 and its constant removal permits rapid drilling rates to be achieved and alleviates unnecessary wear (particularly over the cutting parts of the assembly). These advantageous effects by the application of the flushing air are especially apparent at the chisel-bit end of the drill rod where the outlet port 10 is disposed adjacent to the cutting insert 3 so that air is blasted over the cutting region of that insert.

If required the external cylindrical surface of the skirt 13 can be provided with a heclical web or flange as is conventional for hollow core drills to promote the removal of detritus along the outside of the skirt during rotation of the drill assembly.

Removal of the drill body 2 for servicing or replacement (possibly with one of the different diameter) may readily be achieved by use of an appropriately designed extractor with which the body 2 can be knocked-off to release the frictional engaging frusto conical surfaces. Desirably the longitudinal extent of the tapered surface 11 is greater than that of the tapered surface 13 as illustrated so that any wear between these surfaces can be accommodated for by longitudinal displacement of the tapered portion 11 further into the tapered aperture 13.

CLAIMS

1. A rotary/percussive drill assembly which consists of a longitudinally extending drill rod and a hollow core drill body carried by said drill rod with the rod extending longitudinally through the drill body; said drill rod comprising a cutting part at one end, at its other end a shank part by which the assembly is to be engaged with a rotary/percussive drilling machine, and a longitudinally extending externally tapered portion which converges towards its cutting part; said hollow core drill body comprising a base having an internally tapered aperture within which said externally tapered portion is received in complementary manner to provide frictional driving engagement between the drill rod and the drill body, a skirt extending longitudinally from said base in the direction of the drill rod cutting part to provide a mouth through which the drill rod extends, and an array of cutting parts on the drill body peripherally disposed about the mouth, and wherein the drill rod is provided with an internal conduit which communicates between an inlet port in the shank part and an outlet port disposed longitudinally between the cutting part of the drill rod and the region of engagement between the internal and external tapers and through which flushing fluid is to be passed into the region of cutting for the assembly.

2. An assembly as claimed in claim 1 in which the inlet port is located in an end face of the drill rod.

3. An assembly as claimed in either claim 1 or claim 2 and comprising at least two outlet ports.

4. An assembly as claimed in any one of the preceding claims in which the or an outlet port is positioned at or adjacent to the cutting part of the drill rod to direct flushing fluid primarily into the cutting region of that part.

5. An assembly as claimed in any one of the preceding claims in which the or an outlet port is positioned to direct flushing fluid primarily into the cutting region of the cutting parts on the drill body.

6. An assembly as claimed in any one of the preceding claims in which the externally tapered portion and internally tapered aperture are frusto conical.

7. An assembly as claimed in any one of the preceding claims in which the longitudinal extent of the external tapered portion is greater than that of the internally tapered aperture to accommodate wear between the frictionally engaging surfaces by longitudinal movement of the drill body over the externally tapered portion.

8. An assembly as claimed in any one of

the preceding claims in which the cutting parts of the drill body are provided by hard material inserts secured within that body.

9. An assembly as claimed in any one of the preceding claims in which the cutting part for the drill rod is provided by at least one hard material insert secured within that rod.

10. An assembly as claimed in claim 9 in which the drill rod is provided with a chisel-bit type or a cross-bit type cutting part.

11. An assembly as claimed in any one of the preceding claims in which the hollow core drill body is provided with flushing outlets through which detritus is removable from the cutting region and from the enclosure of the skirt by the flushing action of pressurised fluid.

12. An assembly as claimed in claim 11 in which the flushing outlets comprise apertures or slots in the base or skirt of the drill body.

13. A rotary/percussive drill assembly substantially as herein described with reference to the accompanying illustrative drawing.

14. The combination of a drill assembly as claimed in any one of the preceding claims and a rotary/percussive drilling machine comprising a socket within which the shank part is received and wherein the inlet port communicates with a fluid line in the machine through which fluid under pressure is supplied for flushing.

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